REMARKS

Summary of the Office Action

Claims 1-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Makishima (U.S. Patent No. 5,821,679) in view of Komatsu (U.S. Patent No. 5,814,924) and in view of further remarks.

Claims 1-8 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-27 of U.S. Patent No. 6,285,123 ("the '123 patent"). Claims 1-8 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-46 of copending U.S. Patent Application No. 09/753,722 ("the '722 application").

Summary of the Response to the Office Action

Applicants have amended claim 1 to differently describe the invention. Accordingly, claims 1-8 remain presently pending. Further, Applicants submit two separate Terminal Disclaimers concurrently herewith.

The Rejection under Double Patenting

Claims 1-8 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-27 of the '123 patent. Claims 1-8 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-46 of the '722 application, which is copending with the instant application. While Applicants traverse the rejections, Applicants submit two separate

Terminal Disclaimers concurrently herewith to respectively address each of these two double patenting rejections. These Terminal Disclaimers are being filed in order to facilitate allowance of the present application, thereby obviating the two double patenting rejections. Accordingly, Applicants respectfully request that each of the double patenting rejections be withdrawn.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Makishima in view of Komatsu and in view of further remarks. Claim 1 has been newly-amended to differently describe the invention. To the extent that these rejections might still apply to the claims as newly amended, they are respectfully traversed as follows.

With regard to independent claim 1, the Office Action concedes that Makishima does not disclose "the use of tapered layer in electron-emitting region." However, the Office Action then applies Komatsu as allegedly teaching "how to make tapered electrode (fig 10, fig 11B) using reverse tapered (column 3 line 38) diffusion mask."

Applicants respectfully traverse this rejection, however, because independent claim 1 of the instant application does not merely recite a "tapered layer in the electron-emitting region" as indicated by the Office Action, but instead it more specifically recites that "said insulating layer and said metal thin film electrode include an island region as an electron-emitting section in which film thicknesses thereof are gradually reduced toward said electrode source layer." In other words, as shown, for example, in Fig. 1, the insulating layer 13 and the metal thin film electrode 15 each include the island region 14. Moreover, each of the insulating layer 13 and the metal thin film electrode 15 are gradually reduced toward the electrode source layer 12.

Applicants respectfully submit that one of the features of the present invention is that each of specific electron emission sites of the described electron-emitting devices S comprises an island region in which film thicknesses of both the insulating layer 13 and the metal thin film electrode 15 are gradually reduced towards the electron source layer 12, as shown, for example, in Figs. 1, 15 and 16 of the instant application.

Although the Office Action asserts that Komatsu teaches how to make a tapered electrode (Fig. 10, Fig. 11B) using reverse-tapered diffusion mask (See, for example, col. 3, line 38, Figs. 4A-4D, and col. 6, line 25 – col. 7, line 20 i.e., Second Embodiment), Applicants respectfully submit that Komatsu merely discloses a spindt type field emission source, as described in the Description of the Related Art portion of the present specification. Komatsu's spindt type field emission source requires a large number of complicated manufacturing steps for generating a cone-shaped cathode. In contrast, the present invention employs an island configuration for electron emitting sites without requiring the use of such a cone-shaped cathode.

Komatsu's cone-shaped cathode 68 is a prerequisite for fabricating the emission site, as shown in Figs. 4A-4D of Komatsu. The cone-shaped cathode 68 has to be disposed centrally within the opening of the insulating layer 66 as well as the gate electrode 70. The gate electrode 70 has to be disposed circumferentially about the cone-shaped cathode 68 as a rim of the opening aligned concentric thereto. That is, the cone-shaped cathode is the datum point for alignment between the cathode and the openings of both the insulating layer 66 and the gate electrode 70.

As shown in Fig. 4B of Komatsu, during thermal oxidation, the diffusion mask 62 inhibits the formation of silicon dioxide and at the same time the formation of the silicon dioxide layer 66 is generated from the Si substrate around the mask 62, resulting in the formation of the

cone-shaped cathode 68 from the substrate 64. After deposition of the gate electrode layer 70, the etching process shown in Fig. 4D results in an alignment between the cathode and the openings of both the insulating layer 66 and the gate electrode 70.

Applicants respectfully submit that Makishima discloses an electron device employing a field-emission cathode in which concave portions, each having a flat bottom, are formed in a substrate 1 formed of metal or semiconductor. Each bottom portion is provided with an electron emission layer 5 made of a flat thin diamond film, as shown in Fig. 1 of Makishima. A gate electrode 4 for drawing out the electrons is uniformly formed above the beam formation electrode 2 protruded from the substrate 1.

The arrangement disclosed in Makishima does not have any portion protruding from the substrate in the manner discussed above with regard to Komatsu. As a result, Applicants respectfully submit that there is no motivation to combine the arrangement disclosed in Makishima with the methodology described in Komatsu because the alignment of the center of the opening of gate electrode 4 is not necessary in Makishima.

Further, in the manufacturing process disclosed in Komatsu, the tapered electrode portion of the gate electrode layer 70, as shown in Fig. 4D, is unintentionally formed. Applicants note that there is a hollow space between the gate electrode opening 72 and the insulating layer opening 74 which is formed by etching the insulating layer 66 under the diffusion mask 62 around the cone-shaped cathode 68. Applicants respectfully submit that such a hollow space cannot constitute any island structure, especially in the manner described in connection with the instant application and as currently recited in the claims. Komatsu's cone-shaped cathode 68, made of Si, emits electrons to a vacuum space, but not the gate electrode.

In contrast, in the arrangement disclosed in connection with the present invention, the island region 14 emits electrons passing through the insulating layer 13 and the metal thin film electrode 15, which are gradually reduced in thickness towards the electron source layer 12.

Moreover, Applicants respectfully submit that another feature of the present invention is the provision of a photoconductive layer 2 in combination with an array of electron-emitting devices S facing one another in an image pickup device, as shown, for example, in Figs. 1, 15 and 16 of the instant application. The photoconductive layer 2 is connected to the output circuit via the transparent electroconductive film 3, as shown in Fig. 1. Each electron-emitting device S is driven by the ohmic electrode 11 connected to the output circuit. After the image pickup device of the invention is illuminated with the incident light, the photoconductive layer 2 receives a formed image with the incident light and then photoelectrically converts the intensity thereof into electric signals in response to scanning by electron beams supplied from the electron-emitting device S. As a result, the image pickup device outputs the image signals.

Applicants note in particular that the image pickup device arrangement disclosed in the instant application is not a mere display device. Applicants respectfully submit that the Office Action appears to have not properly identified a photoconductive layer provided over the second substrate, as recited in the claimed image pickup device of the present invention.

While the Office Action asserts that Makishima discloses (Fig. 5, Fig. 6) an image pickup device and a photoconductive layer provided over the second substrate, Applicants respectfully submit that there is no description concerning any image pickup device, besides a flat display device, in Makishima. Applicants respectfully submit that the anode 23 provided on the glass plate 21 shown in Fig. 6 of Makishima is not equivalent to the photoconductive layer 2

connected to the output circuit, as shown in Fig. 1 of the present application. Makishima's anode 23 does not perform any photoelectric conversion functionality and is thus quite different from the photoconductive layer 2 described in connection with the instant invention and recited in at least independent claim 1, as newly amended.

Applicants respectfully submit that the arrangement disclosed in Makishima involves the operation of a flat display device shown in Fig. 6, for example. In this arrangement, a certain voltage against the substrate 1 of the cathode 12 is applied to the anode 23. Subsequently, electrons are emitted from the micro cold cathode 11 of the selected pixel, and the electrons allow the fluorescent substance layer 24 to emit light by striking against the layer 24. See col. 7, lines 23-32 of Makishima. Accordingly, the anode 23 functions only to draw electrons from the cathode 12.

Moreover, Applicants respectfully submit that Komatsu also does not teach or suggest an image pickup device. Komatsu also does not teach or suggest any configuration in which both an insulating layer and a metal thin film electrode layer are each gradually reduced together towards an electron source layer in an island region.

Accordingly, Applicants respectfully submit that the teachings of Makishima and Komatsu, whether taken separately or in combination, do not teach or suggest the fabrication of any type of image pickup device because there is no teaching or suggestion in either reference of a photoconductive layer having a photoelectric converting function therein. Applicants respectfully submit that a person having ordinary skill in the subject art of image pickup device fabrication would not be motivated to utilize the teachings of Komatsu and Makishima in combination to develop any type of image pickup device for at least the foregoing reasons.

In summary, Applicants respectfully submit that Makishima and Komatsu, whether taken separately or in combination, do not teach or suggest an image pickup device. These applied references merely teach a flat display device and they fail to teach or suggest any photoconductive layer having a photoelectric converting function usable for an image pickup device. As a result, Applicants respectfully submit that claim 1, as newly amended is not obvious in view of Makishima and Komatsu.

While independent claim 1 as originally filed arguably distinguished from the applied combination of Makishima and Komatsu, Applicants have amended claim 1 in order to expedite the prosecution of this application. For example, the image pickup device combination of independent claim 1 has been amended to include "a photoconductive layer provided over said second substrate on a side of the vacuum space to photoelectrically convert an incident light passing through the second substrate into an electric signal."

Applicants respectfully submit that the subject matter in newly amended claim 1 differs from the teachings in the applied references.

Applicant respectfully asserts that the rejections under 35 U.S.C. § 103(a) should be withdrawn because neither Makishima nor Komatsu, whether taken singly or combined, teach or suggest each feature of independent claim 1, as amended. MPEP § 2143.03 instructs that "[t]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 409 F.2d 981, 180 USPQ 580 (CCPA 1974)." Furthermore, Applicant respectfully asserts that dependent claims 2-8 are allowable at least because of their dependence from claim 1 and the reasons set forth above.

Conclusions

In view of the foregoing, Applicants respectfully request reconsideration and the timely allowance of the pending claims. Should the Examiner feel that there are any issues outstanding after consideration of this response, the Examiner is invited to contact Applicants' undersigned representative to expedite prosecution.

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account 50-0310. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,

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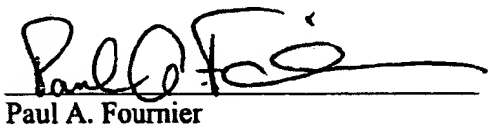
Dated: August 14, 2003 By: 

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